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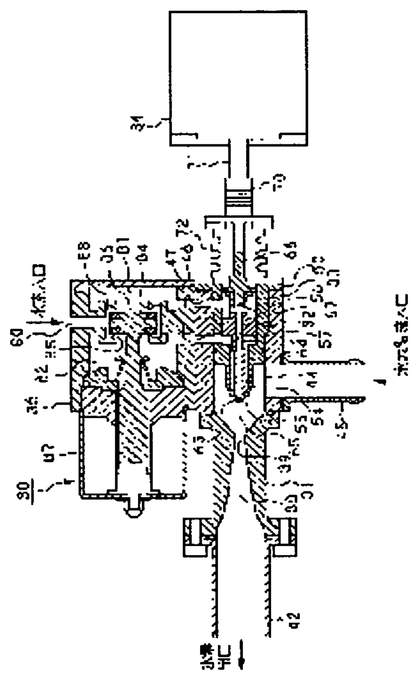
(54) FLUID SUPPLY DEVICE FOR FUEL CELL

(57)Abstract:

PROBLEM TO BE SOLVED: To secure the predetermined stoichiometric characteristic in a wide range from a small flow to a large flow and to secure the required flow of the fluid.

SOLUTION: An ejector 30 is provided with a first nozzle 32 having an opening part 65 at a tip thereof and capable of ejecting the first fluid from the opening part 65, a second nozzle 33 having an opening part 55 at a tip thereof, into which the first nozzle 32 is coaxially inserted to supply the fist fluid and capable of ejecting the supplied first fluid from the opening part 55, a diffuser 31 provided coaxially with the axial direction and sucking the second fluid by the negative pressure generated by the ejection of the first fluid so as to join with the first fluid for feeding, and a driving unit 34 for moving the first nozzle 32 in the axial direction for position change. The first fluid can be supplied to the diffuser 31 from a clearance between the first nozzle 32 and the opening part 55 of the second nozzle 33, while the first fluid can be supplied to the diffuser 31 from the first nozzle 32.



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CLAIMS

[Claim(s)]
[Claim 1] It has opening at a head. The 1st nozzle which can inject the 1st fluid from this opening, It has opening at a head, and said 1st nozzle makes an axis the same, and is inserted in this opening, and the 1st fluid is supplied inside. The 2nd nozzle which can be injected from said opening, The diffuser which attracts the 2nd fluid, is made to join said 1st fluid, and is sent out with the negative pressure which it is prepared in said axis and this direction, and is generated by injection of said 1st fluid, While having the 1st nozzle positioning means which is moved in said direction of an axis and enables repositioning of said 1st nozzle and enabling supply of said 1st fluid to said diffuser from a gap with opening of said 1st nozzle and said 2nd nozzle The fluid feeder of the fuel cell characterized by enabling supply of said 1st fluid to said diffuser from said 1st nozzle.
[Claim 2] Said 1st nozzle is the fluid feeder of the fuel cell according to claim 1 characterized by having the fluid supply cutoff function which intercepts supply of said 1st fluid to said 2nd nozzle when supplying said 1st fluid to said diffuser only from said 1st nozzle.
[Claim 3] It has opening at a head with the needle which has the taper section at a head, and the taper section of said needle makes an axis the same, and is inserted in this opening, and the 1st fluid is supplied inside. The 1st nozzle which can be injected from said opening, It has opening at a head and this opening is arranged near the opening of said 1st nozzle. The 2nd nozzle which can inject the 1st fluid from said opening, The diffuser which attracts the 2nd fluid, is made to join said 1st fluid, and is sent out with the negative pressure which a needle, and said said 1st nozzle and axis are made the same, and it is prepared, and is generated by injection of said 1st fluid, While having the needle positioning means which is moved in said direction of an axis and enables repositioning of said needle and enabling supply of said 1st fluid to said diffuser from the gap of said needle and opening of said 1st nozzle The fluid feeder of the fuel cell characterized by enabling supply of said 1st fluid to said diffuser from said 2nd nozzle.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the fluid feeder used for supply systems, such as a fuel of a fuel cell.
[0002]
[Description of the Prior Art] As opposed to the cel which the solid-state macromolecule membrane type fuel cell put the solid-state polyelectrolyte film from both sides with the anode and the cathode conventionally, and was formed It has the stack (it is called a fuel cell to below) constituted by carrying out the laminating of two or more cels. Hydrogen is supplied to an anode as a fuel, air is supplied to a cathode as an oxidizer, the hydrogen ion generated by catalytic reaction in the anode passes the solid-state polyelectrolyte film, and moves even a cathode, and with a cathode, oxygen and electrochemical reaction are caused and it generates electricity.
[0003] Here, in order to maintain the ion conductivity of a solid-state molecule electrolyte membrane, superfluous water is mixed with humidification equipment etc. by the hydrogen supplied to a fuel cell. For this reason, water collects on the gas passageway in the electrode of a fuel cell, and the predetermined blowdown flow rate is set to the blowdown fuel so that this gas passageway may not be closed.
[0004] Under the present circumstances, by mixing and carrying out the recirculation of the blowdown fuel (it being hereafter called hydrogen backflow) to the fuel (namely, hydrogen) newly introduced into a fuel cell, a fuel can be utilized effectively and the energy efficiency of a solid-state macromolecule membrane type fuel cell can be raised. Conventionally, the fuel cell equipment to which the recirculation of the fuel is carried out with an ejector is known like the fuel cell equipment indicated by JP,9-213353,A as fuel cell equipment which was mentioned above.
[0005] If an ejector is explained here, as shown in drawing 13 , the conventional common ejector forms the ** style rooms 2 successively to end face opening of the diffuser 1 which makes the shape of a trumpet, opens the ** style path 3 for free passage in this ** style room 2, projects the nozzle 4 arranged on a diffuser 1 and the same axle in the ** style room 2, makes end face opening of a diffuser 1 face that head, and is constituted. If the hydrogen newly introduced into a fuel cell in this ejector is turned to a diffuser 1 and injected from a nozzle 4, negative pressure will occur in the throat section 5 of a diffuser 1, and the hydrogen backflow introduced into the ** style room 2 by this negative pressure is attracted in a diffuser 1, and the hydrogen and hydrogen backflow which were injected from the nozzle 4 will be mixed, and it will be sent out from the outlet of a diffuser 1.
[0006] SUTOIKI is in the index which shows the attraction effectiveness of this ejector. Here, if it says in said example, it will be defined as SUTOIKI as a ratio (Qt/Qa) of the hydrogen flow rate (namely, hydrogen supply full flow supplied to a fuel cell) Qt which flows out of the diffuser to the hydrogen flow rate (namely, hydrogen consumption flow rate) Qa spouted from a nozzle. Moreover, if the hydrogen backflow flow rate attracted by the diffuser from a ** style room is set to Qb, since it is Qt=Qa+Qb, SUTOIKI will be defined as (Qa+Qb)/Qa. Thus, if SUTOIKI is defined, it can be said that attraction effectiveness is large, so that a SUTOIKI value is large.
[0007] By the way, since the diameter of a diffuser and the diameter of a nozzle are being fixed in one ejector in the conventional ejector, it is common to select and use the optimal path respectively at operating fluid-flow within the limits. In this case, the fluid flow rate (if it says in said example, it will be hydrogen consumption flow Q a) from which the SUTOIKI value of an ejector becomes max is determined as a fixed value. A SUTOIKI value becomes small although hydrogen consumption flow Q a will become large, if hydrogen consumption flow Q a decreases and the diameter of a nozzle becomes large on the other hand,

although a SUTOIKI value will rise if drawing 14 shows an example of the experimental result which asked the relation (henceforth a SUTOIKI property) between a SUTOIKI value and hydrogen consumption flow Q a for the diameter of a nozzle as a parameter in the ejector for fuel supply of a fuel cell and the diameter of a nozzle becomes small.
[0008] Here, in the case of the fuel cell, since a hydrogen flow rate changed also ten to 20 times from an idling to output at full gate opening in being a fuel cell powered vehicle after the SUTOIKI value (henceforth a demand SUTOIKI value) demanded according to the operational status of a fuel cell is decided as a thick continuous line shows drawing 14 , it was difficult [it] to continue throughout a hydrogen flow rate with one ejector, and to satisfy a demand SUTOIKI value.
[0009]
[Problem(s) to be Solved by the Invention] In order to avoid this problem, 2 ream change ejector system with a bypass path which changes and uses the ejector for the small flow rates which combined the minor diameter nozzle and the minor diameter diffuser, and the ejector for large flow rates which combined the major-diameter nozzle and the major-diameter diffuser is proposed by these people (application for patent No. 85291 [2000 to]). Although the SUTOIKI engine performance it can continue and be satisfied with the range large in comparison of the engine performance from a small flow rate to a large flow rate was securable by this method, when two ejectors and a passage change means were needed, in order to be the further improvement in the SUTOIKI engine performance, it was necessary the increase of a number, and to carry out and to change [of 3, 4, and an ejector] the ejector of these large number, enlargement of equipment and the increase of weight were caused, and it was disadvantageous.
[0010] Moreover, although it is not an ejector for fuel supply in a fuel cell, the adjustable flow rate ejector is proposed in JP,8-338398,A or JP,9-236013,A. The movable rod is built in in the direction of an axis inside the nozzle, and the adjustable flow rate ejector indicated by JP,8-338398,A enables it to change the opening area at the head of a nozzle by moving this rod in the direction of an axis. However, in this adjustable flow rate ejector, when opening area was made small at the time of the small flow rate of what can change a SUTOIKI value by changing the opening area at the head of a nozzle, there was a problem that the SUTOIKI engine performance for which wall surface resistance increases and asks could not be obtained.
[0011] On the other hand, the adjustable flow rate ejector indicated by JP,9-236013,A prepares two or more nozzles from which it is made movable in the direction of an axis, or a path differs a nozzle to a diffuser, and makes a nozzle exchangeable. In this adjustable flow rate ejector, since the diameter of a nozzle cannot be changed if nozzles are not exchanged, as that the SUTOIKI value demanded is continuous and an ejector carried in the fuel cell powered vehicle which changes for a short time, it is not suitable. Then, this invention offers the fluid feeder of the fuel cell which can secure the predetermined SUTOIKI engine performance in a wide range flow rate region.
[0012]
[Means for Solving the Problem] The fuel cell built over invention indicated to claim 1 in order to solve the above-mentioned technical problem The fluid feeder (for example, ejector 30 in the gestalt of the 1st operation) of (the fuel cell [for example,] 11 in the gestalt of the 1st operation) It has opening (for example, opening 65 in the gestalt of the 1st operation) at a head. The 1st nozzle which can inject the 1st fluid (for example, hydrogen in the gestalt of the 1st operation) from this opening (for example, the 1st nozzle 32 in the gestalt of the 1st operation), It has opening (for example, opening 55 in the gestalt of the 1st operation) at a head, and said 1st nozzle makes an axis the same, and is inserted in this opening, and the 1st fluid is supplied inside. The 2nd nozzle which can be injected from said opening With the negative pressure which it is prepared in (for example, the 2nd nozzle 33 in the gestalt of the 1st operation), and said axis and this direction, and is generated by injection of said 1st fluid, the 2nd fluid The diffuser which attracts (for example, the hydrogen backflow in the gestalt of the 1st operation), is made to join said 1st fluid, and is sent out (for example, diffuser 31 in the gestalt of the 1st operation), The 1st nozzle positioning means which is moved in said direction of an axis and enables repositioning of said 1st nozzle (For example, actuator 34 in the gestalt of the 1st operation) While having and enabling supply of said 1st fluid to said diffuser from a gap with opening of said 1st nozzle and said 2nd nozzle It is characterized by enabling supply of said 1st fluid to said diffuser from said 1st nozzle.
[0013] Thus, with constituting, when supplying the 1st fluid of a small flow rate to a diffuser, the 1st fluid can be supplied to a diffuser only from the 1st nozzle, and when supplying the 1st fluid of a large flow rate to a diffuser, the 1st fluid can be supplied to a diffuser from a gap with opening of the 1st nozzle and the 2nd nozzle. And when supplying the 1st fluid to a diffuser from a gap with opening of the 1st nozzle and the 2nd nozzle, the opening area of a gap with opening of the 1st nozzle and the 2nd nozzle can be continuously

changed by moving in the direction of an axis and repositioning the 1st nozzle with the 1st nozzle positioning means. Therefore, the 1st fluid supplied to a diffuser can be continuously adjusted from a small flow rate to a large flow rate. Since it can supply only from the 1st nozzle when supplying the 1st fluid of a small flow rate to a diffuser especially, wall surface resistance which the 1st fluid receives at this time can be made small.

[0014] Invention indicated to claim 2 is characterized by equipping said 1st nozzle with the fluid supply cutoff function which intercepts supply of said 1st fluid to said 2nd nozzle when supplying said 1st fluid to said diffuser only from said 1st nozzle in the fluid feeder of said fuel cell according to claim 1. Thus, with constituting, a continuous change of the opening area of the gap of the change of the supply passage to the diffuser of the 1st fluid and opening of the 1st nozzle and the 2nd nozzle can be made by moving the 1st nozzle in the direction of an axis with said 1st nozzle positioning means. Therefore, a fluid feeder can be operated with one actuator.

[0015] The fluid feeder (for example, ejector 200 in the gestalt of the 3rd operation) of the fuel cell (for example, fuel cell 11 in the gestalt of the 3rd operation) concerning invention indicated to claim 3 The needle which has the taper section (for example, taper section 221 in the gestalt of the 3rd operation) at a head (for example, needle 203 in the gestalt of the 3rd operation), It has opening (for example, opening 214 in the gestalt of the 3rd operation) at a head, and the taper section of said needle makes an axis the same, and is inserted in this opening. Inside The 1st fluid (For example, the hydrogen in the gestalt of the 3rd operation) is supplied. The 1st nozzle which can be injected from said opening (for example, the 1st nozzle section 202 in the gestalt of the 3rd operation), It has opening (for example, opening 231 in the gestalt of the 3rd operation) at a head, and this opening is arranged near the opening of said 1st nozzle. The 2nd nozzle which can inject the 1st fluid from said opening With the negative pressure which a needle, and said said 1st nozzle and axis are made the same, and it is prepared, and is generated by injection of said 1st fluid, the 2nd fluid [(for example, the 2nd nozzle section 204 in the gestalt of the 3rd operation), and] The diffuser which attracts (for example, the hydrogen backflow in the gestalt of the 3rd operation), is made to join said 1st fluid, and is sent out (for example, diffuser section 201 in the gestalt of the 3rd operation), The needle positioning means which is moved in said direction of an axis and enables repositioning of said needle (For example, actuator in the gestalt of the 3rd operation) While having and enabling supply of said 1st fluid to said diffuser from the gap of said needle and opening of said 1st nozzle, it is characterized by enabling supply of said 1st fluid to said diffuser from said 2nd nozzle.

[0016] Thus, with constituting, when supplying the 1st fluid of a small flow rate to a diffuser, the 1st fluid can be supplied to a diffuser only from the 2nd nozzle, and when supplying the 1st fluid of a large flow rate to a diffuser, the 1st fluid can be supplied to a diffuser from the gap and the 2nd nozzle of opening of the 1st nozzle, and a needle. And the opening area of the gap of opening of the 1st nozzle and a needle is continuously changeable by moving in the direction of an axis and repositioning the 1st nozzle with the 1st nozzle positioning means. Therefore, the 1st fluid supplied to a diffuser can be continuously adjusted from a small flow rate to a large flow rate. Since it can supply only from the 2nd nozzle when supplying the 1st fluid of a small flow rate to a diffuser especially, wall surface resistance which the 1st fluid receives at this time can be made small.

[0017]

[Embodiment of the Invention] Hereafter, the gestalt of operation of the fluid feeder of the fuel cell concerning this invention is explained with reference to the drawing of drawing 12 from drawing 1 .

[Gestalt of the 1st operation] Drawing 1 is system configuration drawing of the fuel-supply system of the fuel cell equipped with the fluid feeder concerning this invention. The fuel-supply system of this fuel cell is carried in cars, such as an electric vehicle, is equipped with a fuel cell 11, the humidification section 13, the oxidizer feed zone 14, the heat exchange section 15, the water separation section 16, an ejector (fluid feeder) 30, and the fuel-supply lateral pressure control section 18, and is constituted.

[0018] The fuel cell 11 consisted of a stack constituted by carrying out the laminating of two or more cels to the cel which put the solid-state polyelectrolyte film which consists for example, of solid-state polymer ion exchange membrane etc. from both sides with the anode and the cathode, and was formed, and is equipped with the fuel electrode with which hydrogen is supplied as a fuel, and the air pole to which the air which contains oxygen as an oxidizer is supplied.

[0019] Air exhaust port 20b in which the air exhaust valve 21 for discharging outside air supply opening 20a to which air is supplied from the oxidizer feed zone 14, the air in an air pole, etc. was formed is prepared in the air pole. On the other hand, 20d of fuel exhaust ports for discharging outside fuel-supply opening 20c to which hydrogen is supplied, the hydrogen in a fuel electrode, etc. is prepared in the fuel electrode.

[0020] It supplies air to the fuel-supply lateral pressure control section 18 while the oxidizer feed zone 14 consists of an air compressor, is controlled according to the input signal from the load and accelerator pedal (graphic display abbreviation) of a fuel cell 11 etc. and supplies air to the air pole of a fuel cell 11 through the heat exchange section 15. The heat exchange section 15 warms the air from the oxidizer feed zone 14 to predetermined temperature, and supplies it to the fuel cell 11.
[0021] The hydrogen as a fuel is supplied to the fuel electrode of a fuel cell 11 from fuel-supply opening 20c through the fuel-supply lateral pressure control section 18, an ejector 30, and the humidification section 13. After the humidification section 13 mixed the steam in the hydrogen supplied and humidified hydrogen, it was supplied to the fuel cell 11, and it has secured the ion conductivity of a solid-state molecule electrolyte membrane.
[0022] The ejector 30 is formed in the passage which connects the fuel-supply lateral pressure control section 18 and the humidification section 13. Although the configuration of an ejector 30 is explained in full detail later, as shown in drawing 1 and drawing 2 , the fuel-supply lateral pressure control section 18 is connected to the hydrogen inlet port 80 of an ejector 30, and the humidification section 13 is connected to the hydrogen outlet pipe 42 of an ejector 30. And the blowdown fuel discharged from 20d of fuel exhaust ports of a fuel cell 11 is removed by the hydrogen backflow inlet pipe 45 of an ejector 30 in moisture in the water separation section 16, and is supplied to it through a check valve 23. An ejector 30 mixes the fuel supplied from the fuel-supply lateral pressure control section 18, and the blowdown fuel discharged from the fuel cell 11, and supplies it to a fuel cell 11.
[0023] The fuel-supply lateral pressure control section 18 consisted of a proportion pressure control valve of for example, an air type, made signal pressure the pressure of the air supplied from the oxidizer feed zone 14, and the fuel which passed the fuel-supply lateral pressure control section 18 has set the pressure which it has at the outlet of the fuel-supply lateral pressure control section 18, i.e., a supply pressure, as a predetermined value.
[0024] Next, an ejector 30 is explained with reference to drawing 2 and drawing 3 . Drawing 2 is the whole ejector 30 sectional view, and drawing 3 is the sectional view expanding and showing an important section. The ejector 30 is considering a diffuser 31, the 1st nozzle 32, the 2nd nozzle 33, the actuator 34, and the change valve 35 as main configurations.
[0025] It comes to connect 37 [block / 2nd] on the same axis, and the 1st block of the fluid channel 38 whose diffuser 31 is located in the downstream, which is located in 36 and the upstream the 1st block and which is penetrated in the direction of an axis is formed in 36. The diameter expansion section 41 whose diameter is expanded continuously gradually is formed as it has the throat section 39 from which a bore becomes that middle with min, the converging section 40 whose diameter is reduced continuously gradually is formed as it progresses in the direction of a lower stream of a river rather than this throat section 39 at the upstream, and a fluid channel 38 progresses in the direction of a lower stream of a river rather than the throat section 39 at the downstream. The breadth include angle of the diameter expansion section 41 is smaller than the breadth include angle of the converging section 40 of the upstream. In addition, in drawing 2 and drawing 3 , the left is a lower stream of a river, and the right serves as the upstream. The 1st block of the hydrogen outlet pipe 42 is connected to the downstream edge of 36.
[0026] The 2nd block of the breakthrough 43 penetrated in the direction of an axis is formed in 37, and the 1st block of the down-stream edge of this breakthrough 43 is open for free passage to the converging section 40 of 36. Insertion immobilization of the 2nd block of the 2nd nozzle 33 is carried out from the upstream opening at the breakthrough 43 of 37.
[0027] The 2nd nozzle 33 has the flange 50 fixed to the upstream edge of 37 by the 2nd block of a seal condition, the major diameter 51 which it is formed successively in the direction of a lower stream of a river from this flange 50, and is inserted in the breakthrough 43 of 37 the 2nd block, and the narrow diameter portion 52 formed successively in the direction of a lower stream of a river from this major diameter 51. Moreover, the 2nd nozzle 33 is equipped with the major-diameter hole 53 which carries out opening to a flange 50, and the minor diameter hole 54 which is open for free passage to this major-diameter hole 53, and is prolonged in the downstream, and the minor diameter hole 54 stands in a row in the opening 55 which carries out opening by the downstream end face of the 2nd nozzle 33. And the 2nd block of the space of the downstream serves as the ** style room 44 from the 2nd nozzle 33 in the breakthrough 43 of 37, and the 2nd block of the hydrogen backflow inlet pipe 45 which supplies hydrogen backflow to the ** style room 44 is connected to 37.
[0028] The 1st nozzle 32 is inserted in the interior of the 2nd nozzle 33. For the 1st nozzle 32, it has the upper narrow diameter portion 62 formed successively by the upstream along the direction of an axis from

the major diameter 60 which can slide in the direction of an axis at a seal condition, the down-stream narrow diameter portion 61 formed successively by the downstream along the direction of an axis from this major diameter 60, and the major diameter 60 in the major-diameter hole 53 of the 2nd nozzle 33. The taper section 63 whose diameter an outer diameter reduces gradually continuously is formed in the point of the downstream narrow diameter portion 62 as it progresses down-stream, and this taper section 63 is inserted in the opening 55 of the 2nd nozzle 33.

[0029] Moreover, the fluid channel 64 prolonged along the direction of an axis is formed in the interior of the 1st nozzle 32, the down-stream edge of a fluid channel 64 stands in a row in the opening 65 which carries out opening by the apical surface of the 1st nozzle 32, i.e., the apical surface of the taper section 63, and the upper edge of a fluid channel 64 is blockaded at the down-stream edge of the 1st nozzle 32 by the movable shaft 66 by which connection immobilization was carried out. And the major diameter 60 of the 1st nozzle 32 has divided the major-diameter hole 53 of the 2nd nozzle 33 to the 1st path 56 of the upstream, and the 2nd path 57 of the downstream. Moreover, the fluid channel 67 which opens a fluid channel 64 and the 1st path 56 for free passage is formed in the 1st nozzle 32.

[0030] The fluid channel 38 of a diffuser 31, the fluid channel 64 of the 1st nozzle 32 and opening 65, and the minor diameter hole 54 and opening 55 of the 2nd nozzle 33 are arranged on the same axis, and are. Moreover, the 1st nozzle 32 is movable in the direction of an axis, and by the axis directional movement of the 1st nozzle 32, while being able to open and close the opening 55 of the 2nd nozzle 33 by the taper section 63 of the 1st nozzle 32, the opening area of the gap of the opening 55 of the 2nd nozzle 33 and the taper section 63 of the 1st nozzle 32 can be changed.

[0031] The movable shaft 66 connected with the 1st nozzle 32 is connected with the power shaft 71 of an actuator 34 through coupling 70, and the 1st nozzle 32 is made to move in the direction of an axis by this actuator 34. Moreover, an actuator 34 consists of for example, linear actuation mold step motors, and is controlled by predetermined based on the output current of a fuel cell 11. The seal of between the 1st nozzle 32 and the movable shaft 66 is carried out by the seal member 72 equipped with metal bellows.

[0032] Moreover, the 2nd block of the fluid channels 46 and 47 of a diffuser 31 which are open for free passage to the 1st path 56 or the 2nd path 57 is formed in 37 and the 2nd nozzle 33, and fluid channels 46 and 47 are connected to the change valve 35. The successive range of the 1st nozzle 32 is regulated by the range which the 1st path 56, a fluid channel 46, and the 2nd path 57 and a fluid channel 47 always open for free passage.

[0033] the change valve 35 is open for free passage to a fluid channel 46 -- the 1st room is open for free passage to 81 and a fluid channel 47 -- with 82 the 2nd room It has the valve chest 83 which is prepared between 82 the 2nd room with 81 the 1st room, and stands in a row at the hydrogen inlet port 80, the 1st annular valve seat 84 is formed in opening which opens the 1st room of 81 and the valve chest 83 for free passage, and the 2nd annular valve seat 85 is formed in opening which opens the 2nd room of 82 and the valve chest 83 for free passage. The 1st valve seat 84 and the 2nd valve seat 85 counter, and are arranged, and the valve element 86 is formed among both the valve seats 84 and 85. a valve element 86 -- electromagnetism -- it is made movable with an actuator 87 -- having -- **** -- the 1st valve seat 84 and the 2nd valve seat 85 -- taking a seat -- alienation has become possible. And if 81 [room / 1st] is intercepted with the valve chest 83 and a valve element 86 sits down to the 2nd valve seat 85 while 82 [room / 2nd] will be open for free passage with the valve chest 83, if a valve element 86 sits down to the 1st valve seat 84, while 81 [room / 1st] is open for free passage with the valve chest 83, 82 [room / 2nd] will be intercepted with the valve chest 83.

[0034] Thus, in the constituted ejector 30, supply hydrogen backflow to the ** style room 44 of a diffuser 31 from the hydrogen backflow inlet pipe 45, and hydrogen is supplied to the hydrogen inlet port 80 of the change valve 35. If hydrogen is injected from the opening 65 of the 1st nozzle 32, or the gap of the opening 55 of the 2nd nozzle 33, and the taper section 63 of the 1st nozzle 32 The injected hydrogen flows to the fluid channel 38 of a diffuser 31, and negative pressure occurs [near the throat section 39] at this time. With this negative pressure, the hydrogen backflow in the ** style room 44 is absorbed by the fluid channel 38, and it mixes with the hydrogen injected from the 1st nozzle 32 or the 2nd nozzle 33, and flows to the hydrogen outlet pipe 42. In addition, the hydrogen and hydrogen backflow which were mixed are supplied to a fuel cell 11 through the humidification section 13 from the hydrogen outlet pipe 42.

[0035] Next, an operation of this ejector 30 is explained with reference to the drawing of drawing 7 from drawing 2 . First, while sitting the valve element 86 of the change valve 35 to the 2nd valve seat 85 as shown in drawing 2 and drawing 3 when the hydrogen flow rate which should be supplied to a fuel cell 11 is a small flow rate, by the actuator 34, the 1st nozzle 32 is advanced to the downstream and the opening 55 of

the 2nd nozzle 33 is blockaded in the taper section 63 (the location of the 1st nozzle 32 at this time is hereafter called initial position).

[0036] Then, the 1st room of the hydrogen supplied to the valve chest 83 from the hydrogen inlet port 80 of the change valve 35 flows from the valve chest 83 to 81, it flows to the 1st path 56 of the 2nd nozzle 33 through a fluid channel 46 further, and flows from the 1st path 56 to the fluid channel 64 of the 1st nozzle 32 through a fluid channel 67, and is injected by the fluid channel 38 of a diffuser 31 from the opening 65 of the 1st nozzle 32. Thereby, negative pressure occurs near the throat section 39 of a diffuser 31, and the hydrogen backflow in the ** style room 44 is absorbed by the fluid channel 38, and the interflow of hydrogen and hydrogen backflow is sent out from the hydrogen outlet pipe 42, and is supplied to a fuel cell 11 by this negative pressure. In this case, since the bore of the opening 65 of the 1st nozzle 32 is small (for example, bore of 0.7mm), as shown in drawing 8 , a high SUTOIKI value can be acquired to a small hydrogen flow rate. In addition, at this time, since 82 [room / 2nd] is intercepted by the valve element 86 from the valve chest 83, there is nothing of the change valve 35 for which the 2nd room of hydrogen is supplied to 82.

[0037] Here, it is defined as SUTOIKI as a ratio (Qt/Qa) of the hydrogen flow rate (namely, hydrogen supply full flow supplied to a fuel cell) Qt sent out from the hydrogen outlet pipe 42 to the hydrogen flow rate (namely, hydrogen consumption flow rate) Qa injected from the gap of the hydrogen flow rate spouted from the opening 65 of the 1st nozzle 32, or the opening 55 of the 2nd nozzle 33 and the taper section 63 of the 1st nozzle 32. Moreover, if the hydrogen backflow flow rate attracted by the fluid channel 38 from the ** style room 44 is set to Qb, since it is Qt=Qa+Qb, SUTOIKI will be defined as (Qa+Qb)/Qa.

[0038] Next, while sitting the valve element 86 of the change valve 35 to the 1st valve seat 84 as shown in drawing 4 when the hydrogen flow rate which should be supplied to a fuel cell 11 is the amount of middle classes, by the actuator 34, the 1st nozzle 32 is retreated a little to the upstream, the taper section 63 is estranged from the opening 55 of the 2nd nozzle 33, and a gap is produced between opening 55 and the taper section 63.

[0039] Then, the 2nd room of the hydrogen supplied to the valve chest 83 from the hydrogen inlet port 80 of the change valve 35 flows from the valve chest 83 to 82, it flows to the 2nd path 57 of the 2nd nozzle 33 through a fluid channel 47 further, and flows from the 2nd path 57 to the minor diameter hole 54, and is injected by the fluid channel 38 of a diffuser 31 from the gap of the opening 55 of the 2nd nozzle 33, and the taper section 63 of the 1st nozzle 32. Thereby, negative pressure occurs near the throat section 39 of a diffuser 31, and the hydrogen backflow in the ** style room 44 is absorbed by the fluid channel 38, and the interflow of hydrogen and hydrogen backflow is sent out from the hydrogen outlet pipe 42, and is supplied to a fuel cell 11 by this negative pressure. In this case, a SUTOIKI value predetermined in the amount of middle classes can be acquired by setting up more greatly than the opening area of the opening 65 of the 1st nozzle 32 the opening area of the gap of opening 55 and the taper section 63. In addition, at this time, since 81 [room / 1st] is intercepted by the valve element 86 from the valve chest 83, there is nothing of the change valve 35 for which the 1st room of hydrogen is supplied to 81. Therefore, hydrogen is not injected from the opening 65 of the 1st nozzle 32.

[0040] Next, the 1st nozzle 32 is further retreated to the upstream by the actuator 34, maintaining the condition of having sat the valve element 86 of the change valve 35 to the 1st valve seat 84, as shown in drawing 5 , when the hydrogen flow rate which should be supplied to a fuel cell 11 is a large flow rate. Then, the opening area of the gap of the opening 55 of the 2nd nozzle 33 and the taper section 63 of the 1st nozzle 32 becomes still larger, and the hydrogen flow rate injected from this gap can be increased. Thereby, a SUTOIKI value predetermined by the large flow rate can be acquired.

[0041] In addition, when hydrogen flow rates are the amount of middle classes, and a large flow rate, how far the 1st nozzle 32 is moved in the direction of the upstream from an initial position What is necessary is just to control an actuator 34 according to a hydrogen flow rate corresponding to this that what is necessary is just to set up the opening area corresponding to the diameter of a nozzle which can satisfy a need SUTOIKI value in drawing 14 so that it may be obtained in the gap of the opening 55 of the 2nd nozzle 33, and the taper section 63 of the 1st nozzle 32. What is necessary is on the other hand, just to change and control the change valve 35 according to a hydrogen flow rate.

[0042] By the way, although hydrogen is not injected from the gap of the opening 55 of the 2nd nozzle 33, and the taper section 63 of the 1st nozzle 32 but he is trying to inject only from the opening 65 of the 1st nozzle 32 in this ejector 30 at the time of a small flow rate, this is based on the following reason. Drawing 6 is SUTOIKI property drawing which made opening area the parameter, when hydrogen was injected only from the opening 65 of the 1st nozzle 32 (the inside of drawing, broken line), and when hydrogen is injected

only from the gap of the opening 55 of the 2nd nozzle 33, and the taper section 63 of the 1st nozzle 32 (the inside of drawing, continuous line).
[0043] This SUTOIKI property drawing shows falling more nearly substantially than a SUTOIKI value when opening area is small (phi 0.7) and the SUTOIKI value when injecting only from the gap of opening 55 and the taper section 63 injects only from the opening 65 of the 1st nozzle 32, and falling rather than a need SUTOIKI value. As for this, wall surface resistance of opening has influenced greatly. The cross section of the opening 65 of the 1st nozzle 32 is shown, drawing 7 (B) shows the cross section of the gap S of opening 55 and the taper section 63, if opening area of drawing 7 (A) is the same, drawing 7 (A) of wall surface resistance is smaller, and wall surface resistance is [drawing 7] clearer [drawing 7 (B) of become / large]. The difference of this wall surface resistance appears notably especially, when opening area is small. So, when a hydrogen flow rate made opening area small by the small flow rate, it enabled it to secure a need SUTOIKI value in this ejector 30, also at the time of a small flow rate, as hydrogen is injected only from the opening 65 of the 1st nozzle 32.
[0044] Thus, a required fuel flow can be sent out to a fuel cell 11, covering the large area of a small flow rate to a large flow rate, and predetermined carrying out SUTOIKI property reservation by adjusting the direction location of an axis of the 1st nozzle 32 by the actuator 34, according to the fuel-supply system of the fuel cell which has the constituted ejector 30, while changing the passage of hydrogen by the change valve 35. Drawing 8 is SUTOIKI property drawing of this ejector 30, and can check that the SUTOIKI property of an ejector 30 approximates and changes to demand SUTOIKI. Moreover, it can check fully satisfying the SUTOIKI engine performance also at the time of a small flow rate.
[0045] [Gestalt of the 2nd operation] Next, the gestalt of operation of the 2nd of the fluid feeder of the fuel cell concerning this invention is explained with reference to drawing 9 and drawing 10 . Although the ejector 30 of the gestalt of said 1st operation was changed to the outside of a diffuser 31 and it had the valve 35, it changes to the ejector 30 of the gestalt of this 2nd operation, and there is no valve 35, the 1st nozzle 32 changes, it has the function of a valve 35, and this point is greatly different from the gestalt of the 1st operation. A same-among drawing sign is hereafter given to the same mode part as the thing of the gestalt of the 1st operation, explanation is omitted, and the ejector 30 of the gestalt of the 2nd operation is explained focusing on a point of difference.
[0046] While standing in a row at the upper edge of the minor diameter hole 54 which stands in a row in the opening 55 at a head, the major-diameter hole 101 which stands in a row at the upper edge of the minor diameter hole 54, and the major-diameter hole 101, the bore hole 102 is formed in the interior of the 2nd nozzle 33 of a diffuser 31 fixed to 37 the 2nd block, and these bores are large in order of the minor diameter hole 54, the inside bore hole 102, and the major-diameter hole 101. The fluid channel 104 which stands in a row at the hydrogen inlet port 120 established in 37 the 2nd block, and carries out opening to the 2nd nozzle 33 by the inner surface of the major-diameter hole 101 is established.
[0047] The 1st nozzle 32 inserted in the interior of the 2nd nozzle 33 is equipped with the taper section 63, the down-stream narrow diameter portion 61, the valve element section 111 formed successively in the direction of the upstream from the down-stream narrow diameter portion 61, the upper narrow diameter portion 112 formed successively in the direction of the upstream from the valve element section 111, and the major diameter 113 formed successively in the direction of the upstream from the upper narrow diameter portion 112. The major diameter 113 is always held in the inside bore hole 102 of the 2nd nozzle 33, and the inside bore hole 102 is attached in it possible [sliding of the direction of an axis]. The fluid channel 64 which is open for free passage to the opening 65 at a head is formed in the interior of the 1st nozzle 32, and the upper edge of a fluid channel 64 is blockaded by the movable shaft 66. Moreover, the fluid channel 114 which opens for free passage to a fluid channel 64 and carries out opening to the 1st nozzle 32 by the peripheral face of the upper narrow diameter portion 112 is established.
[0048] The annular sealant 115 is attached in the downstream end face of the valve element section 111 of the 1st nozzle 32, and the valve element section 111 has migration in the direction of a lower stream of a river regulated when a sealant 115 contacts upstream end-face 101a of the major-diameter hole 101 in the 2nd nozzle 33 (the location of the 1st nozzle 32 at this time is hereafter called initial position). And when the 1st nozzle 32 is located in an initial position, by the sealant 115, the minor diameter hole 54 and the major-diameter hole 101 of the 2nd nozzle 33 are intercepted, the down-stream narrow diameter portion 61 inserts in the opening 55 of the 2nd nozzle 33, and the taper section 63 projects in the downstream rather than opening 55. Moreover, when the 1st nozzle 32 is located in an initial position, the valve element section 111 of the 1st nozzle 32 is estranged and located in the downstream rather than the inside bore hole 102 of the 2nd nozzle 33, and the major-diameter hole 101 of the 2nd nozzle 33 and the inside bore hole 102 are open

for free passage.
[0049] Therefore, when the 1st nozzle 32 is located in an initial position, the hydrogen supplied to the hydrogen inlet port 120 flows in the major-diameter hole 101 of the 2nd nozzle 33 through a fluid channel 104, and flows in a fluid channel 64 from a fluid channel 114 through between the upper narrow diameter portion 112 of the 1st nozzle 32, and the inside bore holes 102 of the 2nd nozzle 33. Consequently, hydrogen will be injected by the fluid channel 38 of a diffuser 31 from the opening 65 of the 1st nozzle 32. This is an operating state at the time of the small flow rate in the ejector 30 of the gestalt of the 2nd operation.
[0050] And if the valve element section 111 advances into an abbreviation seal condition into the inside bore hole 102 of the 2nd nozzle 33 and the valve element section 111 advances into the inside bore hole 102 as it is shown in drawing 10 , when the 1st nozzle 32 is retreated in the direction of the upstream from an initial position, the major-diameter hole 101 of the 2nd nozzle 33 and the inside bore hole 102 will be intercepted by the valve element section 111. Consequently, the hydrogen supplied from the hydrogen inlet port 120 will not flow to the fluid channel 64 of the 1st nozzle 32. That is, hydrogen will not be injected from the opening 65 of the 1st nozzle 32. Moreover, when the sealant 115 of the valve element section 111 estranges from upstream end-face 101a of the major-diameter hole 101 of the 2nd nozzle 33, the major-diameter hole 101 and the minor diameter hole 54 of the 2nd nozzle 33 are open for free passage.
[0051] And if the 1st nozzle 32 retreats to a predetermined location, the taper section 63 of the 1st nozzle 32 will come to be located in the opening 55 of the 2nd nozzle 33, and the opening area of the gap of opening 55 and the taper section 6 will come to change according to the location of the 1st nozzle 32. Therefore, at this time, the hydrogen supplied to the hydrogen inlet port 120 will flow in the major-diameter hole 101 of the 2nd nozzle 33 through a fluid channel 104, and it will pass along the minor diameter hole 54 further, and will be injected by the fluid channel 38 of a diffuser 31 by the flow rate according to that opening area from the gap of opening 55 and the taper section 63. This is an operating state at the time of the amount of middle classes in the ejector 30 of the gestalt of the 2nd operation, and a large flow rate.
[0052] Therefore, a required fuel flow can be sent out to a fuel cell 11, covering the large area of a small flow rate to a large flow rate, and predetermined carrying out SUTOIKI property reservation like the ejector 30 of the gestalt of the 1st operation, by adjusting the location of the 1st nozzle 32 by the actuator 34, according to the ejector 30 of the gestalt of this 2nd operation.
[0053] Especially, the opening area of the gap of the opening 55 of the 2nd nozzle 33 and the taper section 63 of the 1st nozzle 32 is not only changeable, but in the ejector 30 of the gestalt of this 2nd operation, it can change the passage of the hydrogen supplied to the hydrogen inlet port 120 by moving the 1st nozzle 32 in the direction of an axis. That is, the 1st nozzle 32 is equipped with the fluid supply cutoff function (function of the change valve 35 in the gestalt of the 1st operation) which intercepts supply of the hydrogen to the minor diameter hole 54 of the 2nd nozzle 33 when injecting hydrogen only from the opening 65 of the 1st nozzle 32 to a fluid channel 38. Consequently, the change valve 35 becomes unnecessary, in the case of the ejector 30 of the gestalt of this 2nd operation, since an ejector 30 can be operated only in the actuator 34 of the 1st nozzle 32, one actuator can be reduced, therefore structure becomes easy, and it can be made small.
[0054] [Gestalt of the 3rd operation] Next, the gestalt of operation of the 3rd of the fluid feeder of the fuel cell concerning this invention is explained with reference to drawing 11 and drawing 12 . Drawing 11 and drawing 12 are the sectional views showing the important section configuration of the ejector 200 as a fluid feeder of a fuel cell.
[0055] The ejector 200 is equipped with the diffuser section 201, the 1st nozzle section 202, a needle 203, and the 2nd nozzle section 204. The diameter expansion section 213 formed in the downstream is formed in the diffuser section 201 like the ejector 30 of the gestalt of the 1st operation rather than the throat section 211, the converging section 212 formed in the upstream from the throat section 211, and the throat section 211, and this diameter expansion section 213 is connected to the fuel cell 11 through the humidification section 13.
[0056] Moreover, an ejector 200 is equipped with the ** style room 205 which stands in a row in a converging section 212, and supply of the hydrogen backflow inlet port 208 to hydrogen backflow of it is attained at this ** style room 205. The 1st nozzle section 202 has formed identically the throat section 211 and the axis of the diffuser section 201, and the head of the 1st nozzle section 202 stands in a row in the ** style room 205 through opening 214. The upper edge of the 1st nozzle section 202 stands in a row in the needle receipt hole 206 of a major diameter rather than the 1st nozzle section 202. The needle receipt hole 206 is open for free passage at the hydrogen inlet port 207, and hydrogen is supplied through the hydrogen inlet port 207.

[0057] And the needle 203 is formed in the direction of an axis movable in the 1st nozzle section 202 and the needle receipt hole 206. The needle 203 is the taper section 221 whose diameter is gradually reduced as a head progresses to the downstream. Narrow diameter portions 222 are formed successively in the direction of the upstream from this taper section 221, and the valve element sections 223 are formed successively by the upper edge of a narrow diameter portion 222. Medium diameter portions 224 are formed successively in the direction of the upstream from the upper edge of the valve element section 223, and major diameters 225 are formed successively by the upper edge of a medium diameter portion 224. The shaft sections 226 are formed successively in the direction of the upstream from the upper edge of a major diameter 225, and the actuator (not shown) which makes the shaft section 226 move a needle 203 in the direction of an axis is connected.
[0058] A major diameter 225 can slide on the needle receipt hole 206 in accordance with shaft orientations, and the valve element section 223 has a clearance in the direction of a path, and is contained by the needle receipt hole 206. Into the 1st nozzle section 202, a narrow diameter portion 222 has a clearance in the direction of a path, and is inserted, and the taper section 221 is located possible [****] from the opening 214 of the 1st nozzle section 202. Moreover, the sealant 227 is attached in the downstream end face of the valve element section 223, and between [of this sealant 227] these attachment and detachment has become possible at downstream end-face 206a of the needle receipt hole 206. Moreover, when a sealant 227 contacts downstream end-face 206a of the needle receipt hole 206, while the 1st nozzle section 202 and the needle receipt hole 206 are intercepted, migration in the direction of a lower stream of a river of a needle 203 is regulated.
[0059] Moreover, the fluid channel 230 which connects the hydrogen inlet port 207 and the ** style room 205 is established, the head of this fluid channel 230 has become the 2nd nozzle section 204 of a minor diameter, and the opening 231 at the head of this 2nd nozzle section 204 turns that axis to the throat section 211, and is carrying out opening to this ejector 200.
[0060] When supplying the hydrogen of a small flow rate to a fuel cell 11, a sealant 227 is made to contact downstream end-face 206a of the needle receipt hole 206 in this ejector 200, as the downstream is advanced and a needle 203 is shown in drawing 11 . By this, the hydrogen supplied from the hydrogen inlet port 207 will not flow in the 1st nozzle section 202, will be injected towards the throat section 211 through a fluid channel 230 only from the opening 231 of the 2nd nozzle section 204, and will flow to the diameter expansion section 213. By this, negative pressure occurs near the throat section 211, and the hydrogen backflow in the ** style room 205 is absorbed by this negative pressure to the diameter expansion section 213. Consequently, it will be mixed in the diameter expansion section 213, and hydrogen and hydrogen backflow will be sent out to a fuel cell 11.
[0061] And when supplying the hydrogen of the amount of middle classes, or a large flow rate to a fuel cell 11, a sealant 227 is made to estrange from downstream end-face 206a of the needle receipt hole 206, as the upstream is retreated and a needle 203 is shown in drawing 12 . Thereby, the hydrogen supplied from the hydrogen inlet port 207 not only flows to a fluid channel 230, but comes to flow in the 1st nozzle section 202. Consequently, while hydrogen is injected towards the throat section 211 from the opening 231 of the 2nd nozzle section 204, hydrogen will be injected towards the throat section 211 from the gap of the opening 214 of the 1st nozzle section 202, and a needle 203, these hydrogen will join, and it will flow to the diameter expansion section 213 through the throat section 211. By this, negative pressure occurs near the throat section 211, and the hydrogen backflow in the ** style room 205 is absorbed by this negative pressure to the diameter expansion section 213. Consequently, it will be mixed in the diameter expansion section 213, and hydrogen and hydrogen backflow will be sent out to a fuel cell 11.
[0062] And since the opening area of the gap of the opening 214 of the 1st nozzle section 202 and the taper section 221 of a needle 203 is changeable by adjusting the location of a needle 203, the flow rate of the hydrogen injected from this gap is changeable with positioning of a needle 203. Therefore, a required fuel flow can be sent out to a fuel cell 11, covering the large area of a small flow rate to a large flow rate, and predetermined carrying out SUTOIKI property reservation by positioning of a needle 203, in the case of this ejector 200 as well as the ejector 30 of the gestalt of said 1st operation, or the gestalt of the 2nd operation. Moreover, aggravation of the SUTOIKI engine performance at the time of a small flow rate is avoidable.
[0063] moreover, the ejector 30 of the gestalt of the 1st operation, or the gestalt of the 2nd operation mentioned above in this ejector 200 -- since the fluid channel 64 is not formed in the interior of the 1st nozzle 32 (it corresponds to the needle 203 in the gestalt of the 3rd operation) like, the outer-diameter dimension of a needle 203 can be made small, and the bore of opening 214 or the 1st nozzle section 202 can be made small in connection with it.

[0064] Moreover, since he is trying to intercept supply of the hydrogen to the 1st nozzle section 202 in this ejector 200 by making a sealant 227 contact downstream end-face 206a of the needle receipt hole 206 the path clearance of the opening 214 of the 1st nozzle section 202 and a needle 203 when the needle 203 is located in an initial position -- large -- it can carry out -- consequently, the opening 214 of a needle 203 -- it can eat and **** can be prevented.
[0065] In addition, this invention is not restricted to the gestalt of operation mentioned above. For example, if an actuator 34 is not restricted to a linear actuation mold step motor and can justify the 1st nozzle 32 and a needle 203 in the direction of an axis, it is also possible to use other driving means.
[0066]
[Effect of the Invention] Since the 1st fluid supplied to a diffuser can be continuously adjusted from a small flow rate to a large flow rate according to invention according to claim 1 as explained above, it is effective in the ability to send out a required fluid flow rate, securing the predetermined SUTOIKI engine performance from a small flow rate to a large flow rate. Moreover, since the 1st fluid can be supplied to a diffuser only from the 1st nozzle at the time of a small flow rate, aggravation of the SUTOIKI engine performance at the time of a small flow rate is avoidable. Moreover, since nozzles are not exchanged, it is applicable also to that the SUTOIKI value demanded is continuous and the fuel cell powered vehicle which changes for a short time.
[0067] According to invention indicated to claim 2, since a fluid feeder can be operated with one actuator in addition to said effectiveness, structure can be simplified and it can miniaturize.
[0068] Since the 1st fluid supplied to a diffuser can be continuously adjusted from a small flow rate to a large flow rate according to invention according to claim 3, it is effective in the ability to send out a required fluid flow rate, securing the predetermined SUTOIKI engine performance from a small flow rate to a large flow rate. Moreover, since the 1st fluid can be supplied to a diffuser only from the 2nd nozzle at the time of a small flow rate, aggravation of the SUTOIKI engine performance at the time of a small flow rate is avoidable.

[Translation done.]

* NOTICES *

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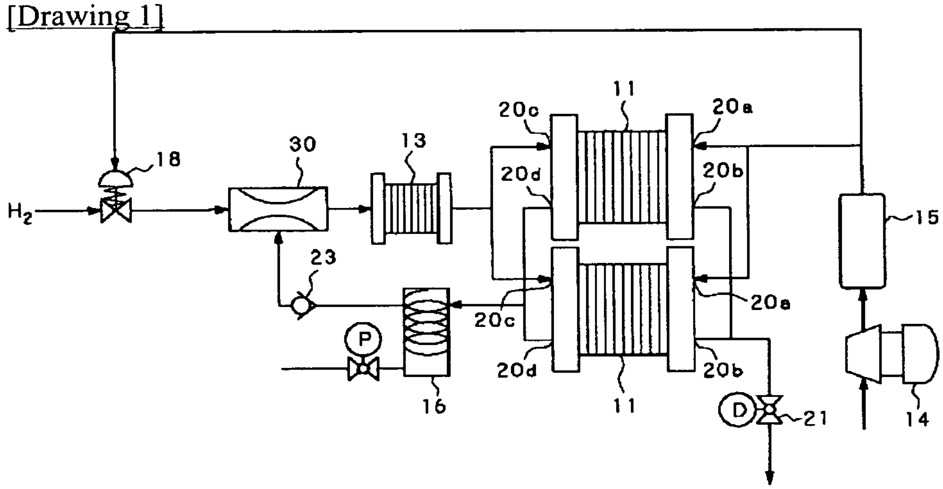
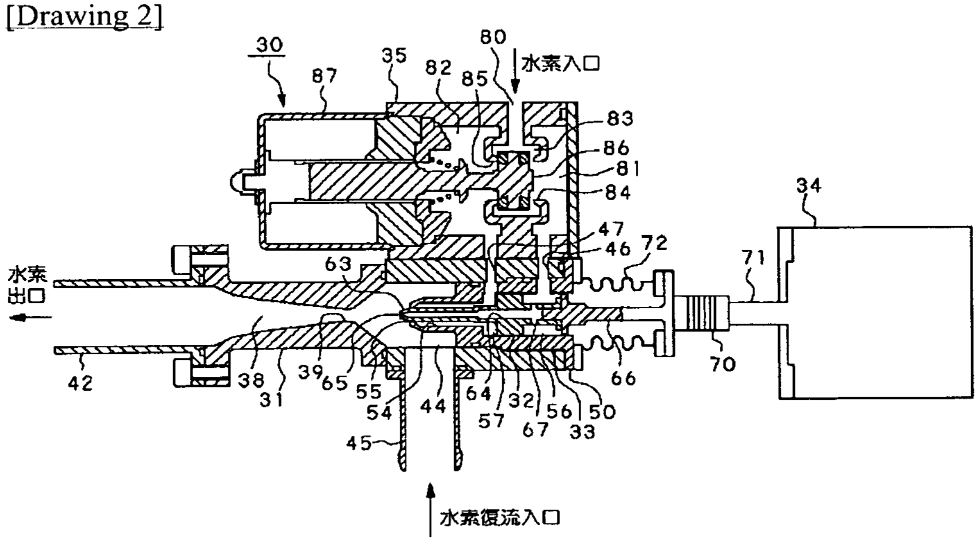
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

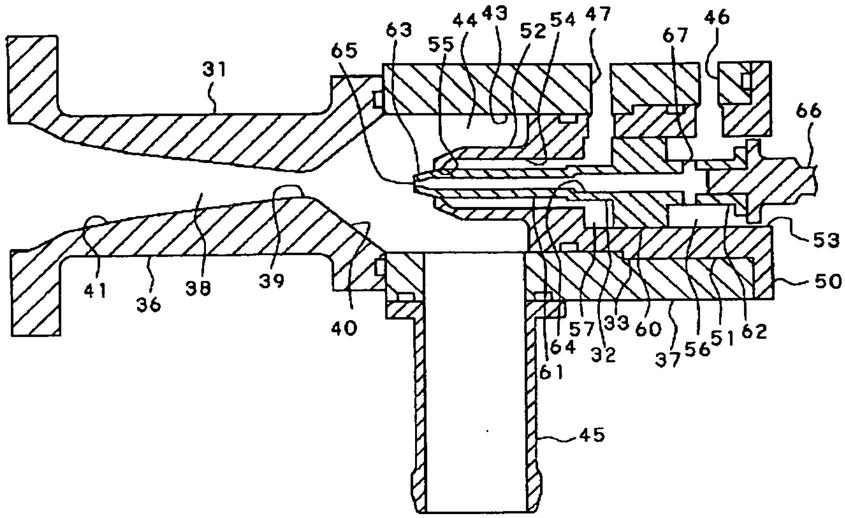
[Drawing 1]



[Drawing 2]



[Drawing 3]



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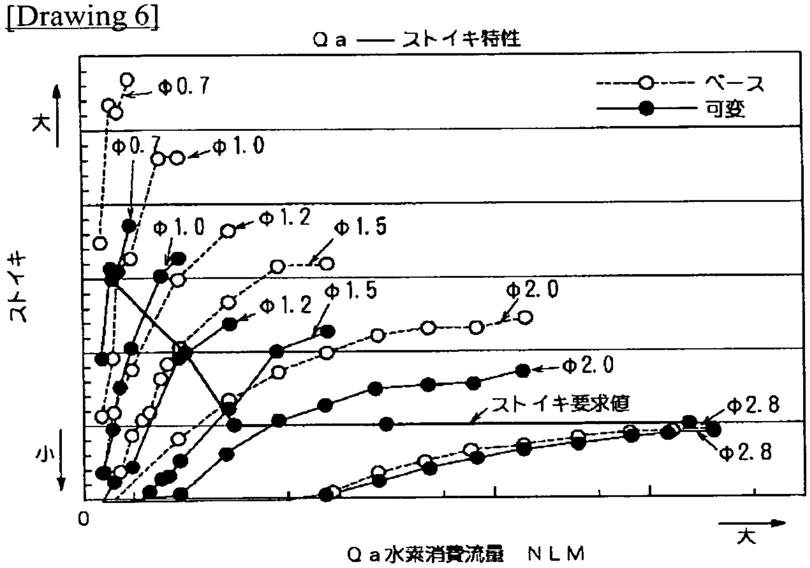

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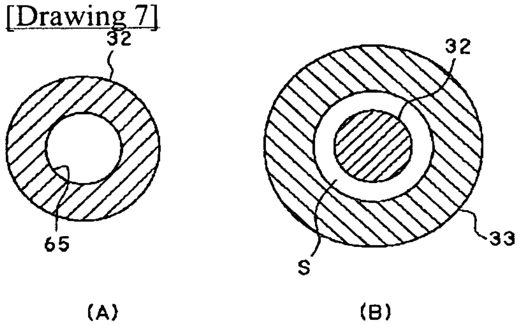

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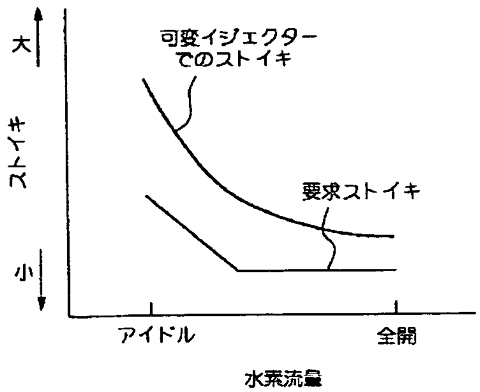

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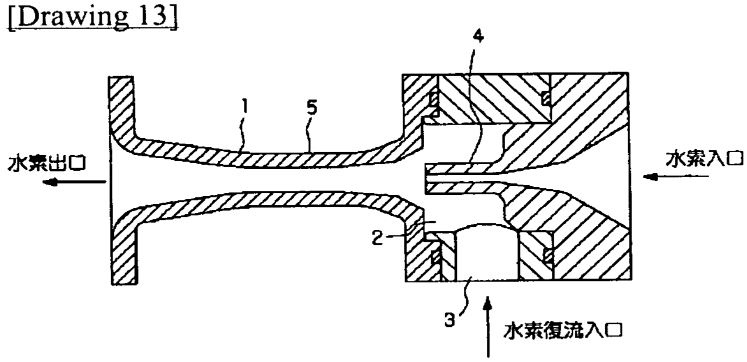

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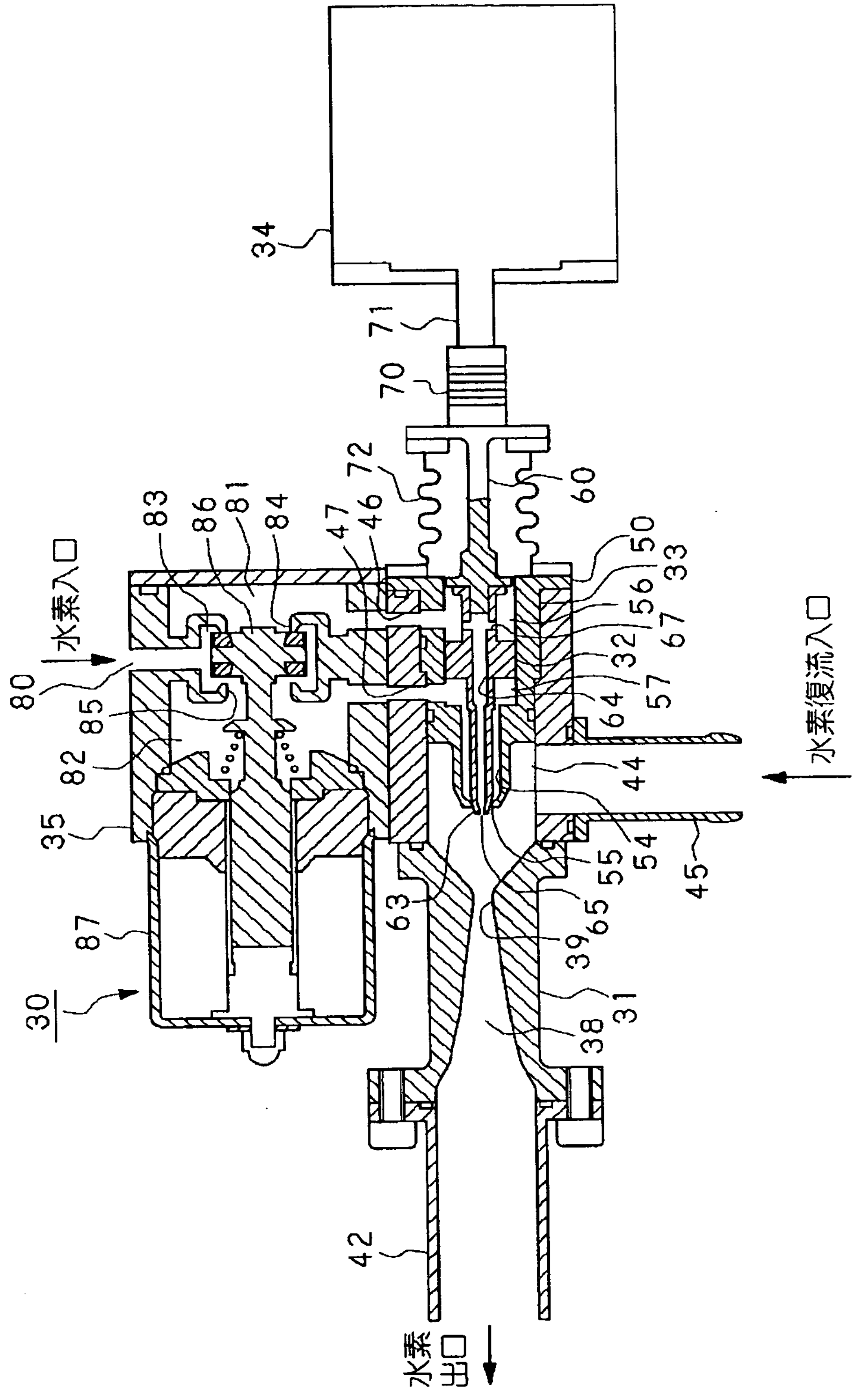
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水素復流入口
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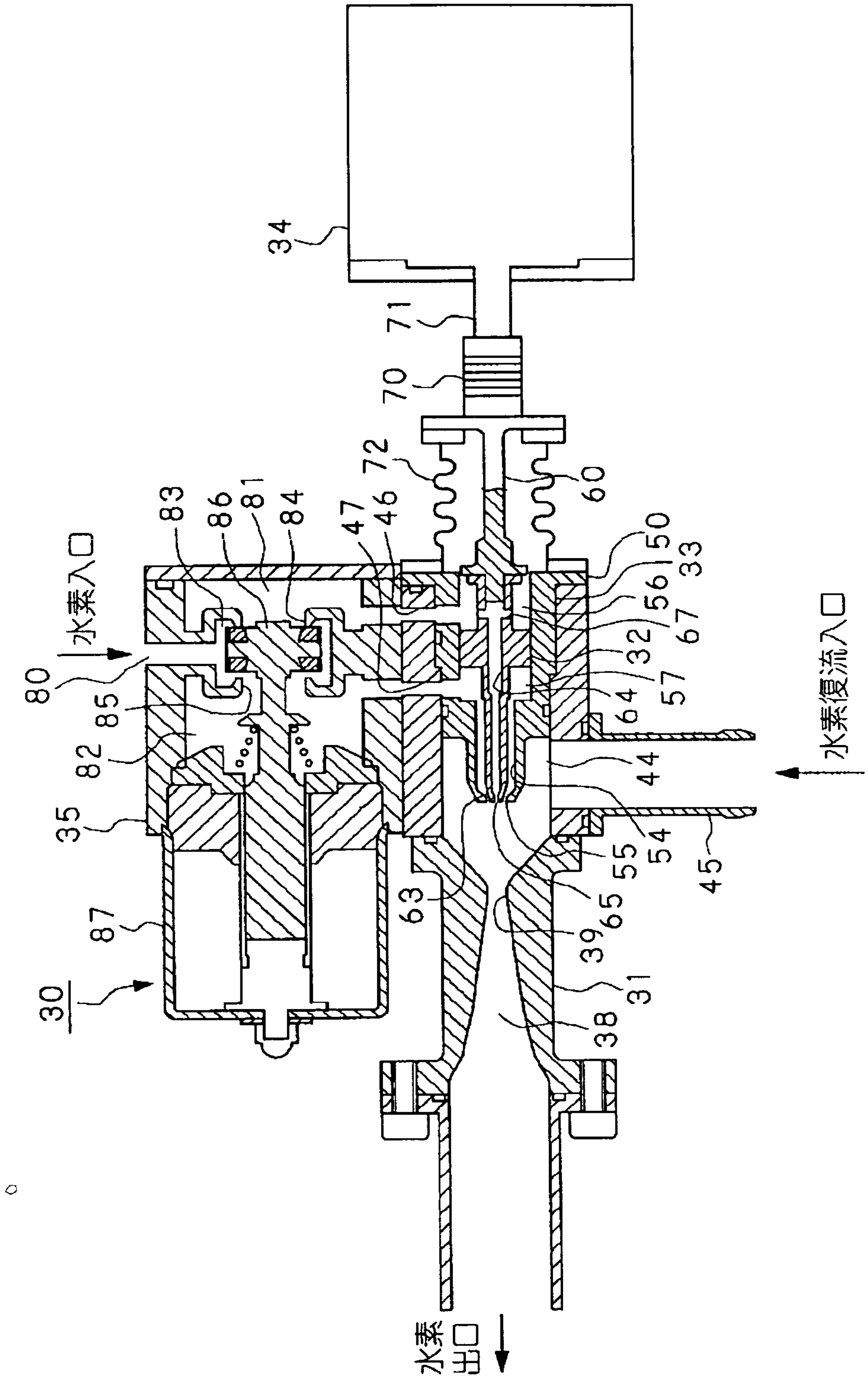
水素出口

[Drawing 5]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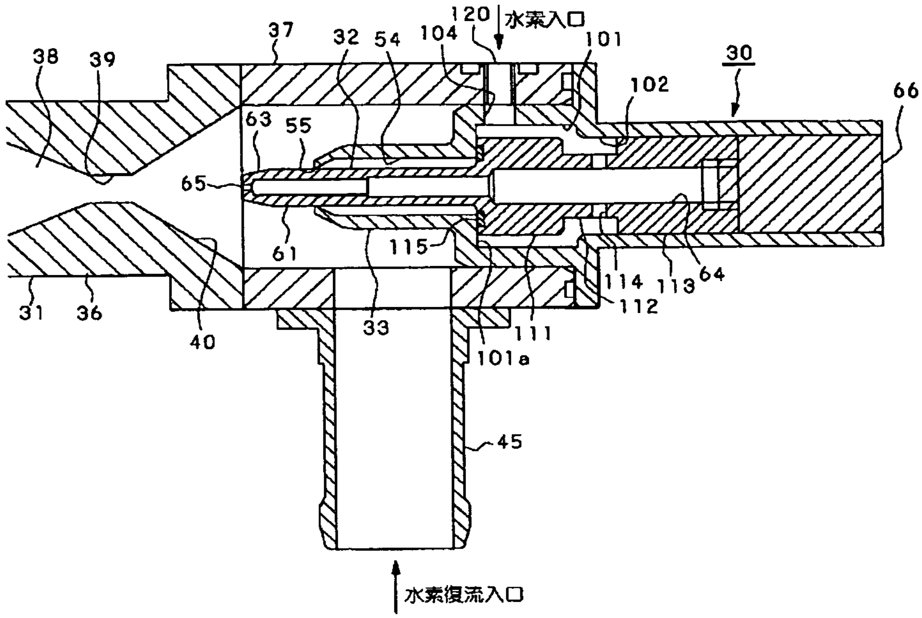
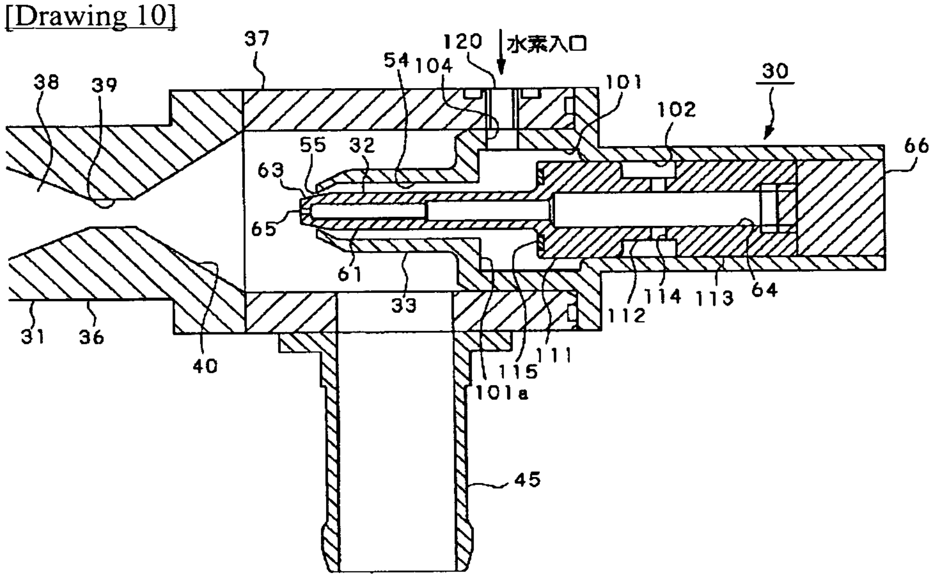
水素復流入口
水素出口

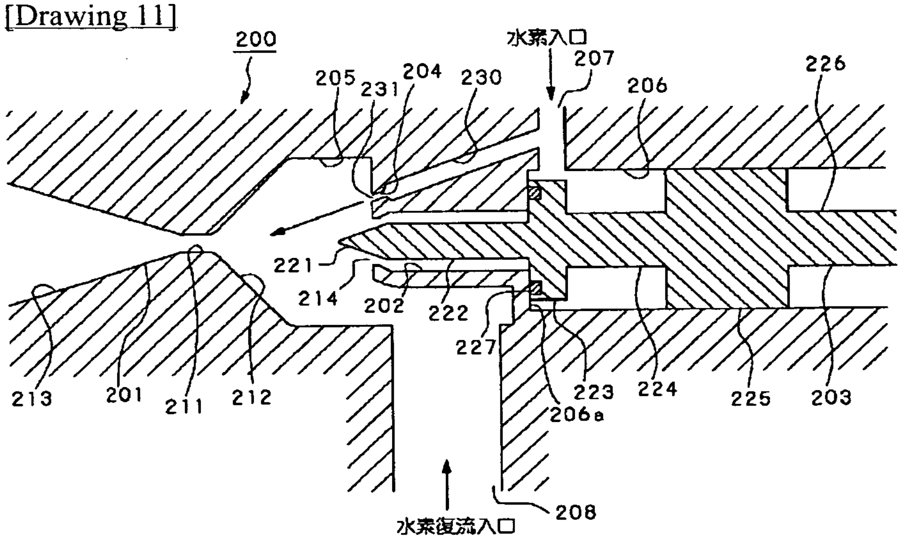
[Drawing 9]



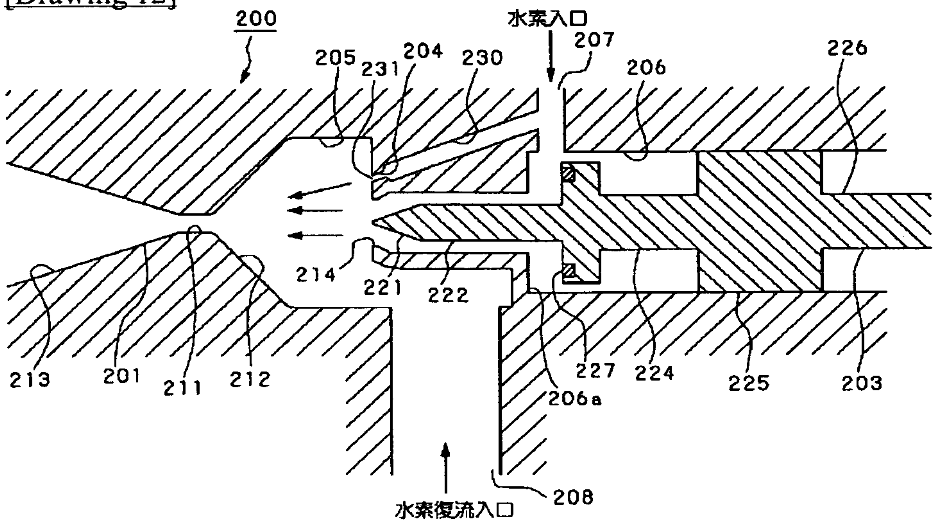
[Drawing 10]



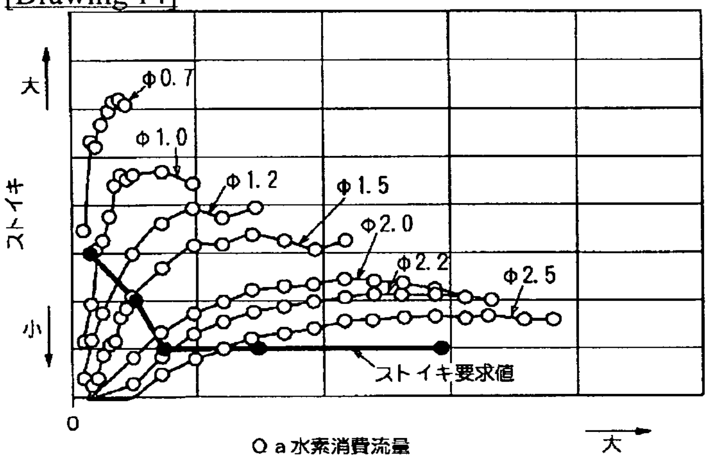
[Drawing 11]



[Drawing 12]



[Drawing 14]



[Translation done.]